

The Domain of the Composition of Two Functions

For each pair of functions f and g below, determine the domain of $f(g(x))$.

1. $f(x) = x^2, g(x) = \sqrt{x}$ $f(g(x)) = (\sqrt{x})^2 = x$ $D: [0, \infty)$

2. $f(x) = \sqrt{x}, g(x) = x^2$ $f(g(x)) = \sqrt{x^2} = x$ $D: (-\infty, \infty)$

3. $f(x) = \sqrt{x}, g(x) = x-3$ $f(g(x)) = \sqrt{x-3}$ $D: [3, \infty)$

4. $f(x) = \frac{1}{x}, g(x) = x-4$ $f(g(x)) = \frac{1}{x-4}$ $D: \{x \mid x \in \mathbb{R}, \text{ except } x \neq 4\}$

5. $f(x) = \frac{1}{x-1}, g(x) = \frac{1}{x}$ $f(g(x)) = \frac{1}{\frac{1}{x}-1} = \frac{1}{\frac{1-x}{x}} = \frac{x}{1-x}$
 $D: \{x \in \mathbb{R}, \text{ except } x \neq 0, 1\}$

6. $f(x) = \frac{1}{\sqrt{x}}, g(x) = \frac{1}{x-2}$ $f(g(x)) = \frac{1}{\sqrt{\frac{1}{x-2}}} = \frac{1}{\frac{1}{\sqrt{x-2}}} = \sqrt{x-2}$ $D: (2, \infty)$

7. $f(x) = \sqrt{x}, g(x) = x^2 + 2x$ $f(g(x)) = \sqrt{x^2 + 2x}$ $D: (-\infty, -2] \cup [0, \infty)$